JUL 1994 START

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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Distribution	ER	N/A
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1/2	/	Cog.Eng. P. J. Valcich H6-04	~~ERC~~ ~~H6-07~~	~~3~~	
1/2	/	Cog. Mgr. M. J. Lauterbach H6-01	EPIC (2) H6-08	3	
		QA	Central Files (2) L8-04	3	
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18. P. J. Valcich — Signature of EDT Originator — Date 6/7/94

19. Authorized Representative for Receiving Organization — Date

20. M. J. Lauterbach — Cognizant/Project Engineer's Manager — Date 6/7/94

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Date Received: 6/28/94/DS

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

Complete for all Types of Release

Purpose

[] Speech or Presentation (Check only one suffix)
- [] Full Paper
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[] Software/Database
[] Controlled Document
[] Other

ID Number (include revision, volume, etc.): WHC-SD-EN-TI-278, Rev. 0

List attachments.

Date Release Required: June 16, 1994

Title: Columbia River Effluent Pipeline Survey

Unclassified Category: UC-

Impact Level: N/A

New or novel (patentable) subject matter? [X] No [] Yes
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[] No [] Yes Disclosure No(s).

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Author/Requestor (Printed/Signature) P. J. Valcich — Date 6/7/94

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Part 1

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6. Author

Name: P. J. Valcich

P J Valcich 6/2/94
Signature

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85900/UB5AB

7. Abstract

WHC, 1994, *Columbia River Effluent Pipeline Survey*, WHC-SD-EN-TI-278, Rev. 0, prepared by Golder Associates Inc. for Westinghouse Hanford Company, Richland, Washington.

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9. Impact Level N/A

10. RELEASE STAMP

OFFICIAL RELEASE BY WHC (11)
DATE JUL 08 1994
Stations # 12

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the results of a comprehensive marine geophysical survey conducted in the Columbia River near the Hanford Reservation (Figure 1). The purpose of this investigation was to map the location and depth of burial of 14 effluent pipelines that extend into the Columbia River. There is concern that some of the pipes may be uncovered which may create a hazard to navigation in this part of the river. The survey was conducted from April 11th to April 17th, 1994 by Golder Associates, Seattle, Washington, under the direction of the Westinghouse Hanford Company, Richland, Washington.

2.0 SURVEY AREAS AND NAVIGATION

2.1 SURVEY AREAS

The fourteen effluent pipelines extend offshore into the Columbia River from eight reactors (100F, 100H, 100D&DR, 100N, 100K, and 100 B&C) in the 100 Area. The information provided by WHC indicated that the pipelines varied in total length from 300 to 1850 feet and from 42 to 102 inches in diameter. Sites DR, and N had single pipes, site B had two single outfall pipes, and sites C, D, F, H, and K had double pipes.

2.2 HORIZONTAL CONTROL AND NAVIGATION

Navigation and positioning of the survey vessel, the R/V Preston, was accomplished with differential GPS. The shore based GPS receivers were placed on surveyed points established by David Evans Associates, the navigation subcontractor for the project. These five shore locations, having both horizontal and vertical control, were surveyed in near five of the 100 area facilities.

Prior to conducting the marine geophysical investigation at each site a GPS receiver and telemetry system were installed on an appropriate shore station. The shore based GPS receiver transmitted real-time corrections to the shipboard GPS receiver at a rate of 1 per second. This information was then used to plot the vessel's position as it moved along preselected survey lines. In addition, vertical control was established at each site and water elevation was monitored at a 15 minute interval during data acquisition.

The preplotted survey lines, and the actual survey lines traversed, were displayed in real-time on a color monitor and plotted on an E-size pen plotter during the geophysical operations. The navigation data acquisition system acquired both the position and depth information at a rate of 1 per second and provided navigation fix marks to the geophysical instruments and graphic recorders at a rate of 5 per minute.

The marine geophysical survey at each site consisted of a series of transects, parallel to the shoreline, run in the upstream direction. These lines were approximately

200 to 300 feet in length, centered on the pipeline, and were spaced at an interval of 20 to 80 feet. At several sites additional lines were run perpendicular to the shoreline to increase coverage of the bathymetric data.

Horizontal control and vessel tracking was done with a Trimble Model 4000SSE Differential GPS system and data acquisition was done with Coastal Navigation Hydropack software.

3.0 GEOPHYSICAL INSTRUMENTATION

A combination of geophysical instruments were evaluated and used in order to obtain the best images of the pipelines. These systems were: an Innerspace Model 488 Precision Digital Echosounder, a EG&G Model 260 Side-Scan Sonar, a Datasonics Model 5000 high-resolution subbottom profiler (SBP), a Datasonics Model 1200 Bubble Pulser seismic reflection system, and a GSSI Model 4800 ground penetrating radar (GPR). Generally, three or more of these systems were run simultaneously. The Precision Echosounder, Side-Scan Sonar, and Ground Penetrating Radar proved to be the best combination of instrumentation for imaging the pipelines. If the pipeline could not be clearly identified with the GPR a number of transects were made with the SBP or Bubble Pulser in an attempt to locate the pipeline. Figure 2 illustrates the shipboard configuration of the geophysical instruments.

3.1 PRECISION BATHYMETRY

The precision bathymetric system uses a single 200kHz transducer to transmit an acoustic pulse and receive the reflected pulse from the river bed. The data, displayed as a profile view of the river bed, are plotted on a thermal graphic recorder and also logged, as digital depths, on the navigation computer. To calibrate the digital echosounder an acoustic velocimeter was used to measure the velocity of sound in the water at each site. This calibration velocity, and the water elevation at each site, were logged and used to correct the bathymetric information during data processing.

3.2 SIDE-SCAN SONAR

The sonargram produced by the side-scan sonar depicts the river bed, in plan view, 150 feet to either side of the survey trackline (Figures 3 and 4). These sonargrams are used to identify and map surficial features on the river bed such as pipelines and associated structures, and the type of sediment, such as mud, sand, rocks, that mantle the river bed.

The patterns on the sonargram represent the intensity of energy reflected, or back-scattered, from the river bed and features resting on the river bed. The amount of reflected energy, represented by variation in darkness of the sonargram, is a function of relief, sediment grain size, and the size of the object resting on the river bed. Objects such as boulders or pipelines, that have significant relief above the river bed, produce an

acoustic shadow which appear as white zones, or areas of low acoustic returns, on the sonargram.

3.3 HIGH-RESOLUTION SUBBOTTOM PROFILER (SBP)

The subbottom profiler (SBP) uses a single transducer to transmit and receive acoustic signals and is similar to the echosounder. However, the acoustic signal of the SBP is much lower in frequency, 3.5kHz vs. 200kHz and has a much greater energy level than the echo-sounder. The lower frequency and higher energy level of the SBP makes it possible to penetrate through the sediments and image the underlying strata, boulders or buried objects such as the pipelines. The data are displayed as continuous profile of the subsurface features and strata. The depth of subsurface penetration typically ranges from 5 to 50 feet, depending on the density characteristics of the sediments. These systems are most useful in silts, clays and fine-grained sediments.

3.4 SEISMIC REFLECTION (BUBBLE PULSER)

The seismic reflection system also produces an image of the subsurface stratigraphy and buried objects, similar to the SBP. However, the acoustic signal from this system is much lower in frequency (500 Hz vs. 3.5kHz) and has considerably more energy than the SBP. In addition, the acoustic source (Bubble Pulser) and receiver (hydrophone) are separate components. Because of its greater energy and lower frequency, this system is capable of achieving much greater subsurface penetration; typically 100 to 1000 feet in sand and gravel. The increase in subsurface penetration, however, is gained at the expense of a reduction in resolution. This system can only resolve stratigraphic layers that are greater than 2 to 3 feet in thickness whereas the SBP can resolve layers that are 4 to 6 inches in thickness.

3.5 GROUND PENETRATING RADAR (GPR)

The ground penetrating radar is also a continuous reflection system, like the SBP and the Bubble Pulser. However, it uses high frequency (100 Mhz) electromagnetic signals instead of acoustic energy to obtain subsurface information. The advantage of the GPR, over the acoustic systems, is that it can penetrate extremely hard materials. In the terrestrial environment these systems are often used to image through concrete and rock. The data from this system are displayed on the same graphic recorder used for the acoustic systems and are presented as cross-section profiles of the subsurface (Figures 3, 4 and 5).

4.0 INTERPRETATION AND RESULTS OF THE GEOPHYSICAL INVESTIGATION

This section briefly discusses the results of the geophysical investigation at each of the sites. A set of maps, included in Appendix B, provides detailed information on the

bathymetry, the alignment of each pipeline, and a profile view of the pipelines (Plates 1-9).

4.1 SITE 100 B-7 (PLATE 1)

The river bed at this site is covered with large cobbles and boulders. The 42-inch pipeline extends approximately 400 feet offshore and is exposed on the river floor over the last 40 feet. The relief of the pipeline where it is exposed varies from 2 to 3 feet. The depth of burial varies from 1 to 3 feet.

4.2 SITE 100 B-8 (PLATE 2)

The river bed is also covered with large cobbles and boulders along this alignment. The 66-inch diameter pipeline extends approximately 400 feet offshore and is exposed on the river bed along the outer 100 feet. The relief at these exposures varies from 1 to 3 feet. Where the pipe is buried, the sediment cover varies from 1 to 3 feet.

4.3 SITE 100 C-4 (PLATE 3)

Large boulders that project 1 to 3 feet above the river bed are present throughout this site. The two 54-inch diameter pipes extend approximately 300 feet offshore (Figure 3). Both of the pipes are exposed at various locations along the lower section of the alignment. The depth of burial for both pipes, along the upper section of the alignment, varies from 1 to 3 feet.

4.4 SITE 100 DR AND 100D (PLATES 4 AND 5)

The river bed along these two alignments appears to be relatively smooth and is interpreted to be predominantly covered with sand, gravel and cobbles. There are two separate alignments, D and DR at this site separated by approximately 500 feet. Both alignments extend offshore approximately 1300 feet. Alignment D contains two 42-inch diameter pipelines that are buried along the entire alignment at a depth of approximately 2 to 7 feet. These two pipelines are not exposed on the riverbed at their termination. Alignment DR consists of one 60-inch pipeline that is buried at a depth of 2 to 6 feet along the alignment. This pipeline is exposed on the riverbed at the outer end.

4.5 SITE 100 F (PLATE 6)

The effluent system at this site consists of two pipes, 42-inch in diameter, with a total length of 300 feet. The side-scan sonar data indicated that the river floor at this site is relatively smooth and that the two pipes, and associated structures, such as pipe supports, extend approximately 80-feet offshore and protude 4 to 8 feet above the river bed. No buried or exposed pipelines could be found further offshore of this point with

any of the geophysical instruments. The two pipelines could not be clearly identified, possibly because of what appears to be large pieces of debris or rip-rap resting on them.

4.6 SITE 100 H (PLATE 7)

The river bed at this site consists of cobbles with occasional large boulders. The two 60-inch diameter pipelines extend approximately 500-feet offshore. Both pipelines are buried along the entire alignment at a depth of 3 to 8 feet (Figure 5). There is no evidence on the side-scan sonar, GPR, or bathymetric data, that the offshore ends of these two pipelines are exposed on the river bed.

4.7 SITE 100 K (PLATE 8)

The river bed at this site is covered with large cobbles and boulders and possible other debris. The two 84-inch diameter pipelines extend approximately 250 feet offshore and are exposed along most of the alignment (Figure 4). The pipelines protude 1 to 3 feet above the river bed at these exposures.

4.8 SITE 100 N (PLATE 9)

The river bed at this site is covered with cobbles and patches of large boulders. The 102-inch pipeline at this site could not be imaged with the GPR, which worked successfully at all of the other sites. Two images on the Bubble Pulser data, that are interpreted to be the pipeline show it to be at a subsurface depth of approximately 8 to 10 feet, which is at the maximum limit of the capability of the GPR. The outer end of the pipeline is exposed on the river floor and has a relief of 3 to 4 feet.

5.0 SUMMARY AND CONCLUSIONS

A comprehensive marine geophysical survey, using precision navigation and echosounding, side-scanning sonar, subbottom profiling, seismic reflection profiling, and ground penetrating radar was used to locate and map 14 effluent pipelines. These pipelines extend into the Columbia River from six abandoned nuclear facilities in the 100 Area of the Hanford Facility.

The sediments covering the river floor varied from coarse sand and gravel to large boulders, some of which are 2 to 3 feet in diameter or larger.

The pipelines varied in length from 300 to approximately 1300 feet offshore. Generally the pipelines were buried along the entire alignment and only exposed on the river bed at the outer end. However, several pipelines (100C, 100F, 100KE) were exposed along the alignment at several locations or were not exposed at all (100D and 100H).

APPENDIX A

FIGURES 1 THRU 5

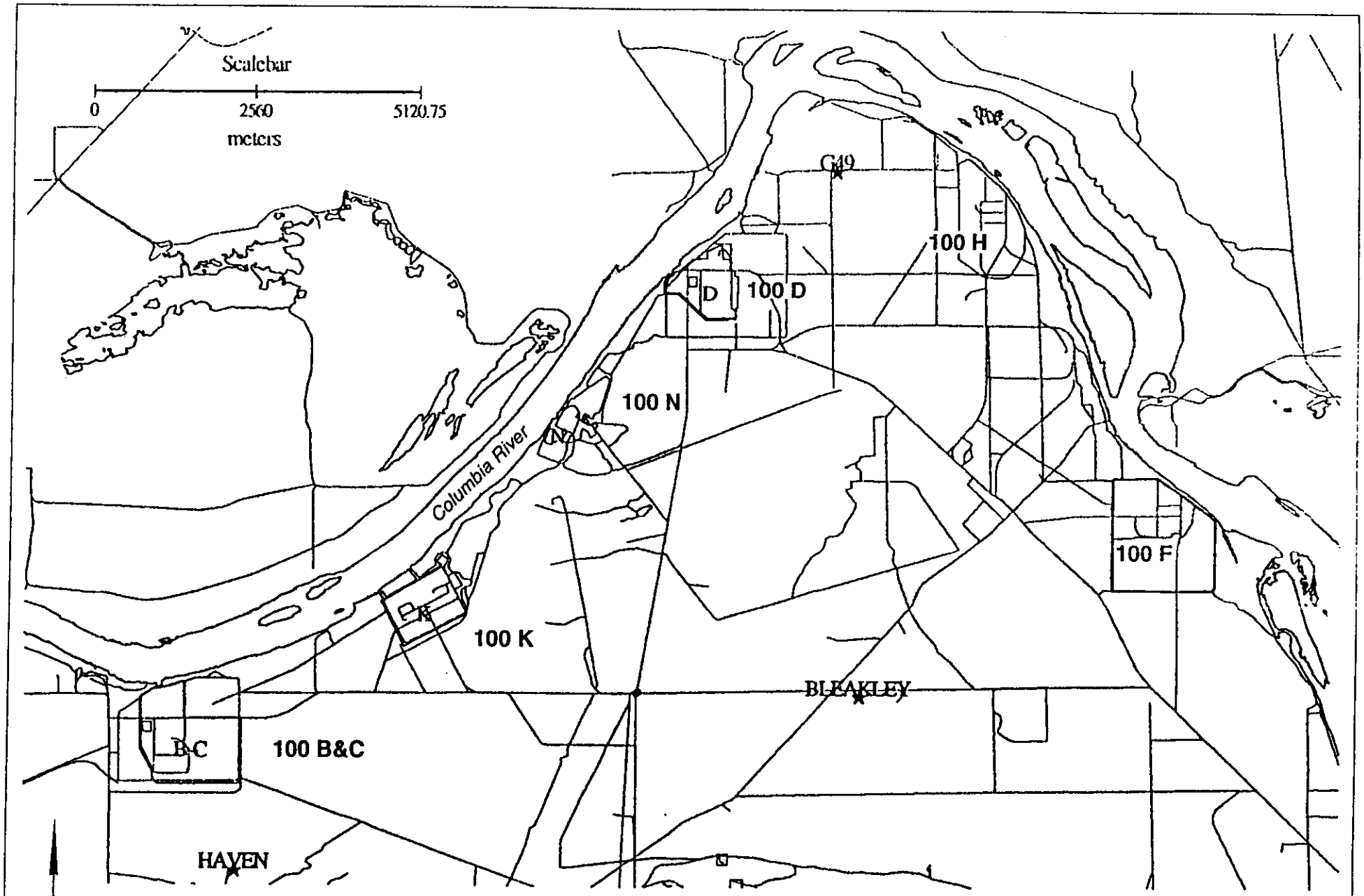


FIGURE 1
GEOPHYSICAL SURVEY LOCATION MAP
WHC/COLUMBIA RIVER HANFORD/WA

PROJECT NO. 943 1104 DRAWING NO. 49500 DATE 6/1/94 DRAWN BY TB

Golder Associates

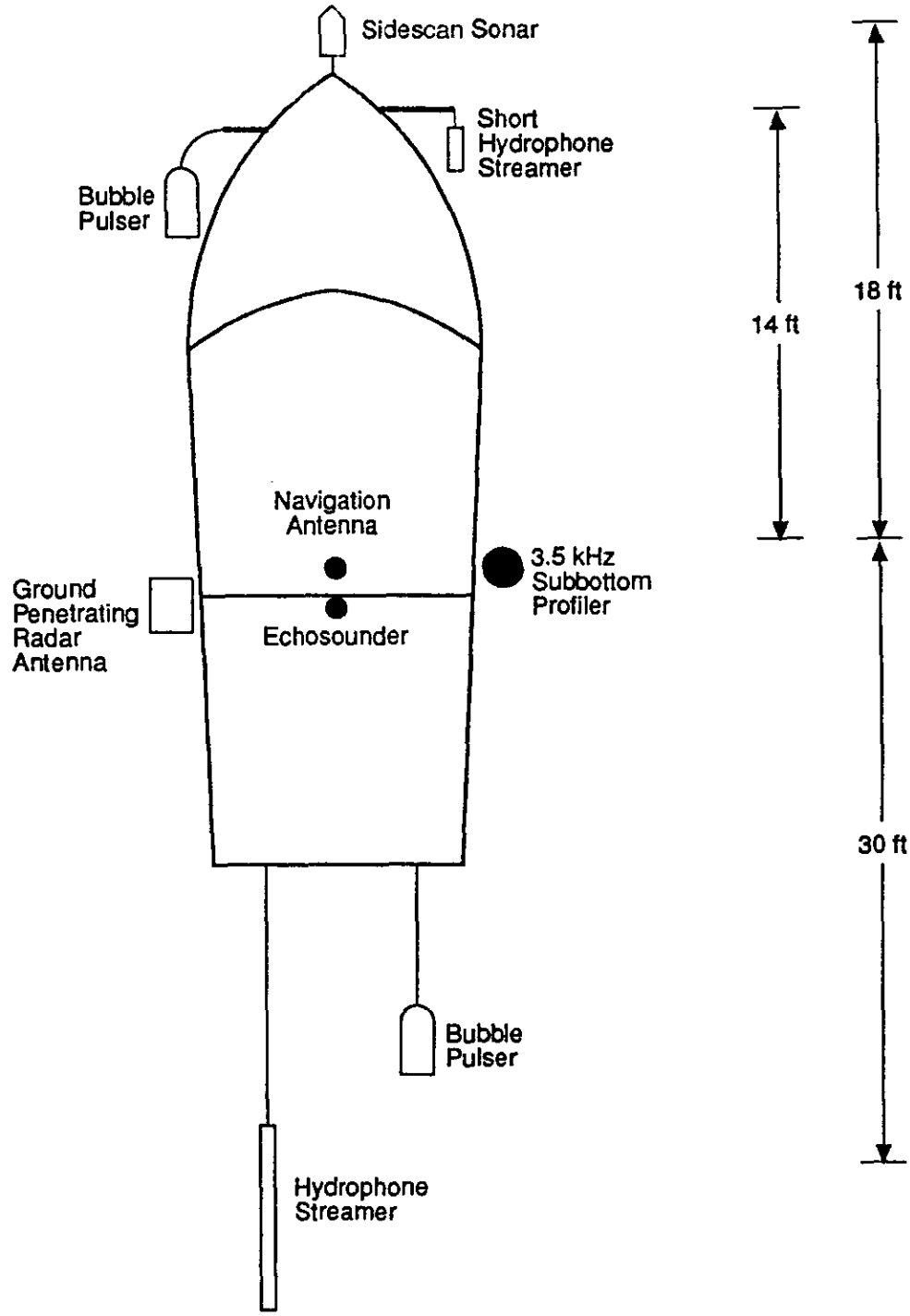
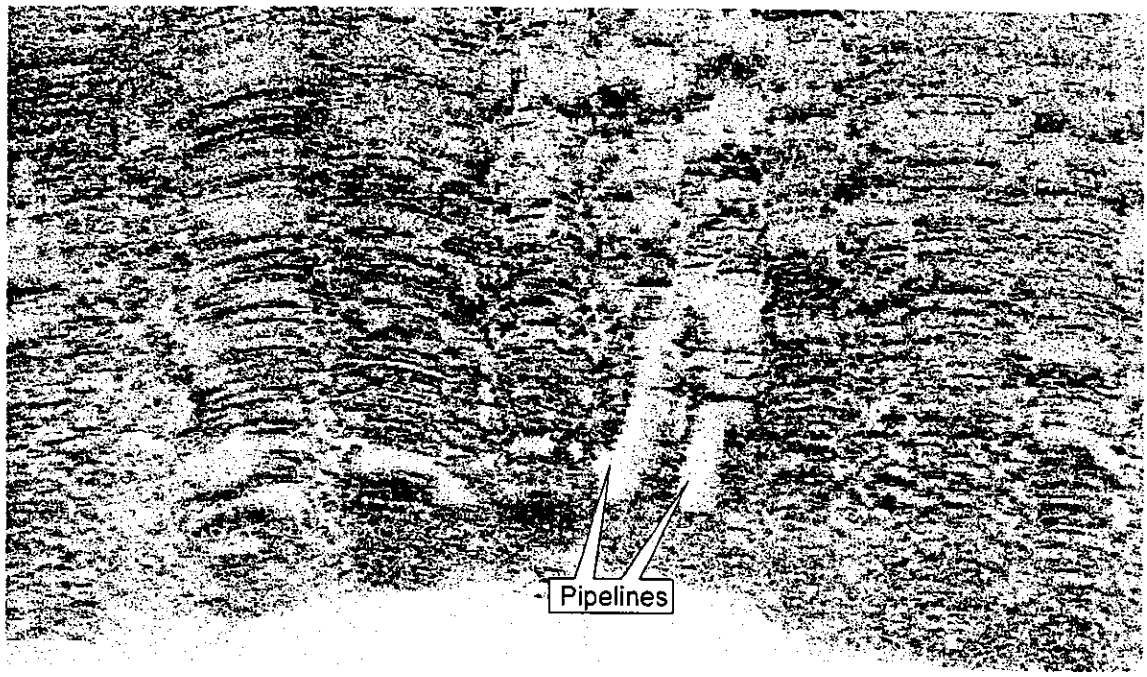


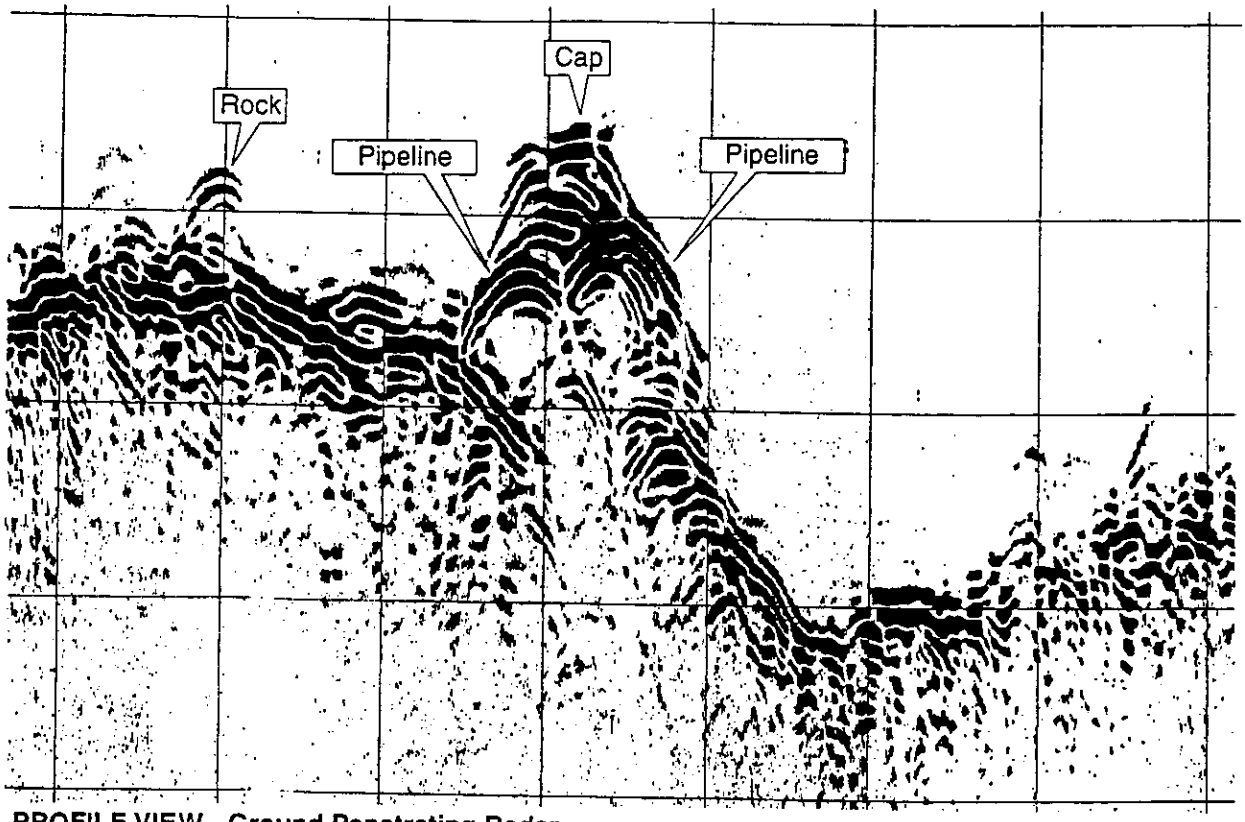
FIGURE 2
GEOPHYSICAL INSTRUMENTATION CONFIGURATION ON RESEARCH VESSEL
WHC/GEOPHYSICS/WA

PROJECT NO. 943 1104 DRAWING NO. 49721 DATE 5/3/94 DRAWN BY CB

Golder Associates



PLAN VIEW - Sidescan Sonar



PROFILE VIEW - Ground Penetrating Radar

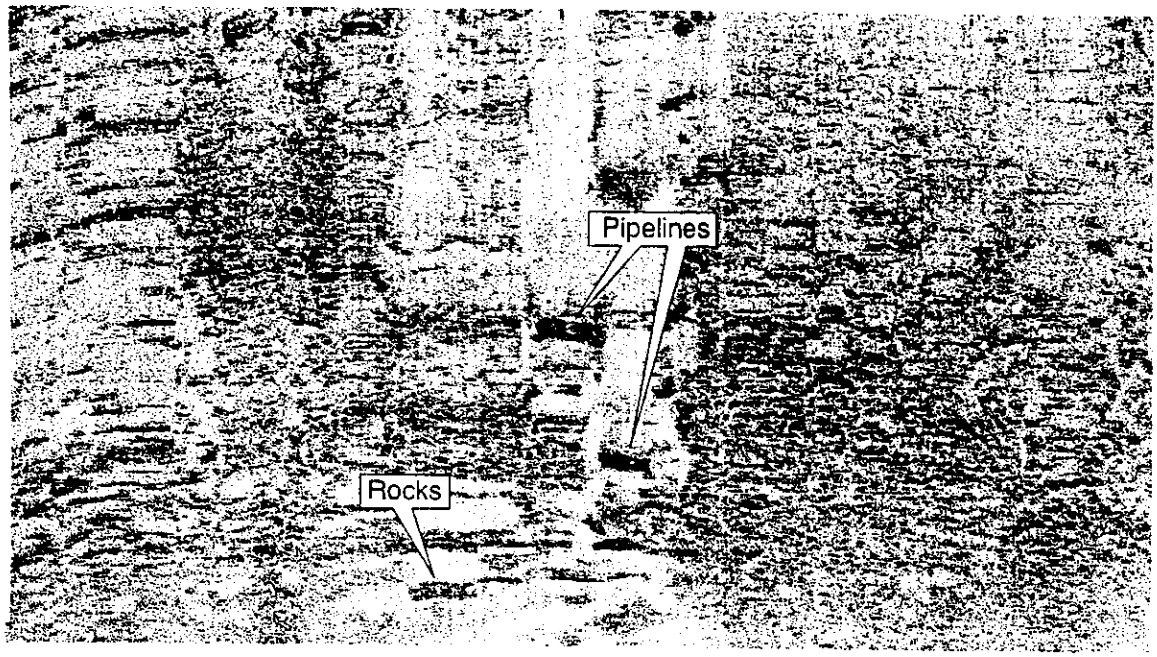
FIGURE **3**

OFFSHORE PIPELINES AT SITE 100 C

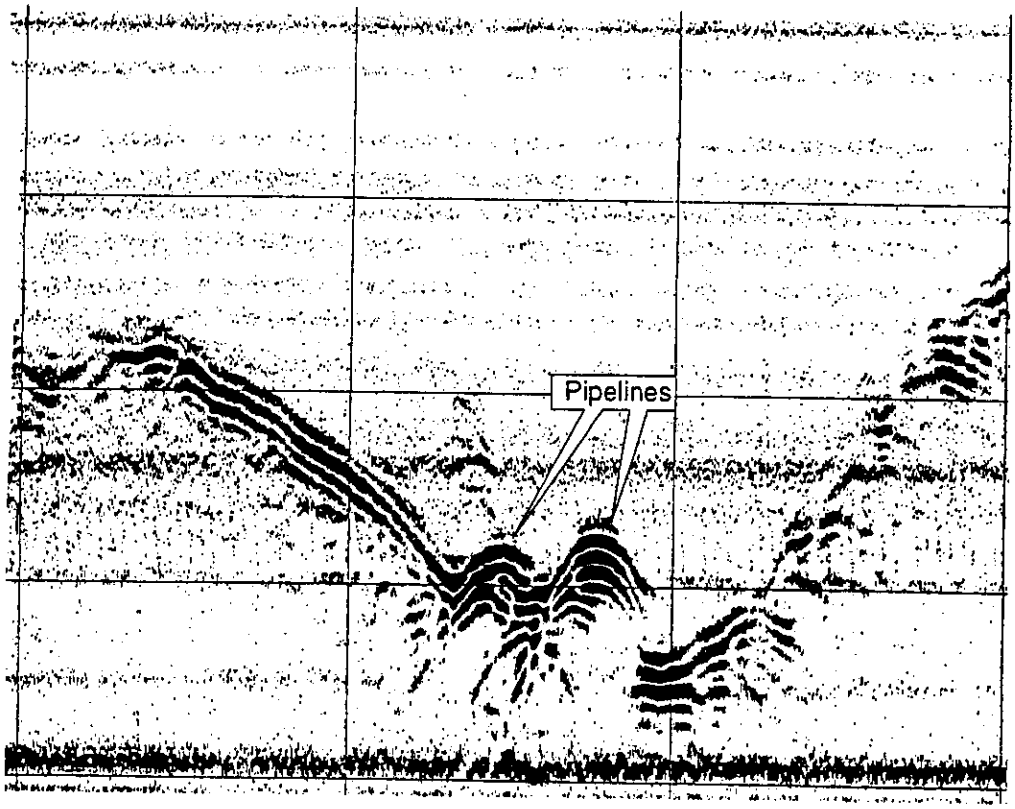
WHC/GEOPHYSICS/WA

PROJECT NO. 943 1104 DRAWING NO. 49720 DATE 6/1/94 DRAWN BY CB

Golder Associates



PLAN VIEW - Sidescan Sonar



PROFILE VIEW - Ground Penetrating Radar

FIGURE **4**

OFFSHORE PIPELINES AT SITE 100 K

WHC/GEOPHYSICS/WA

PROJECT NO. 943 1104 DRAWING NO. 49719 DATE 6/1/94 DRAWN BY CB

Golder Associates

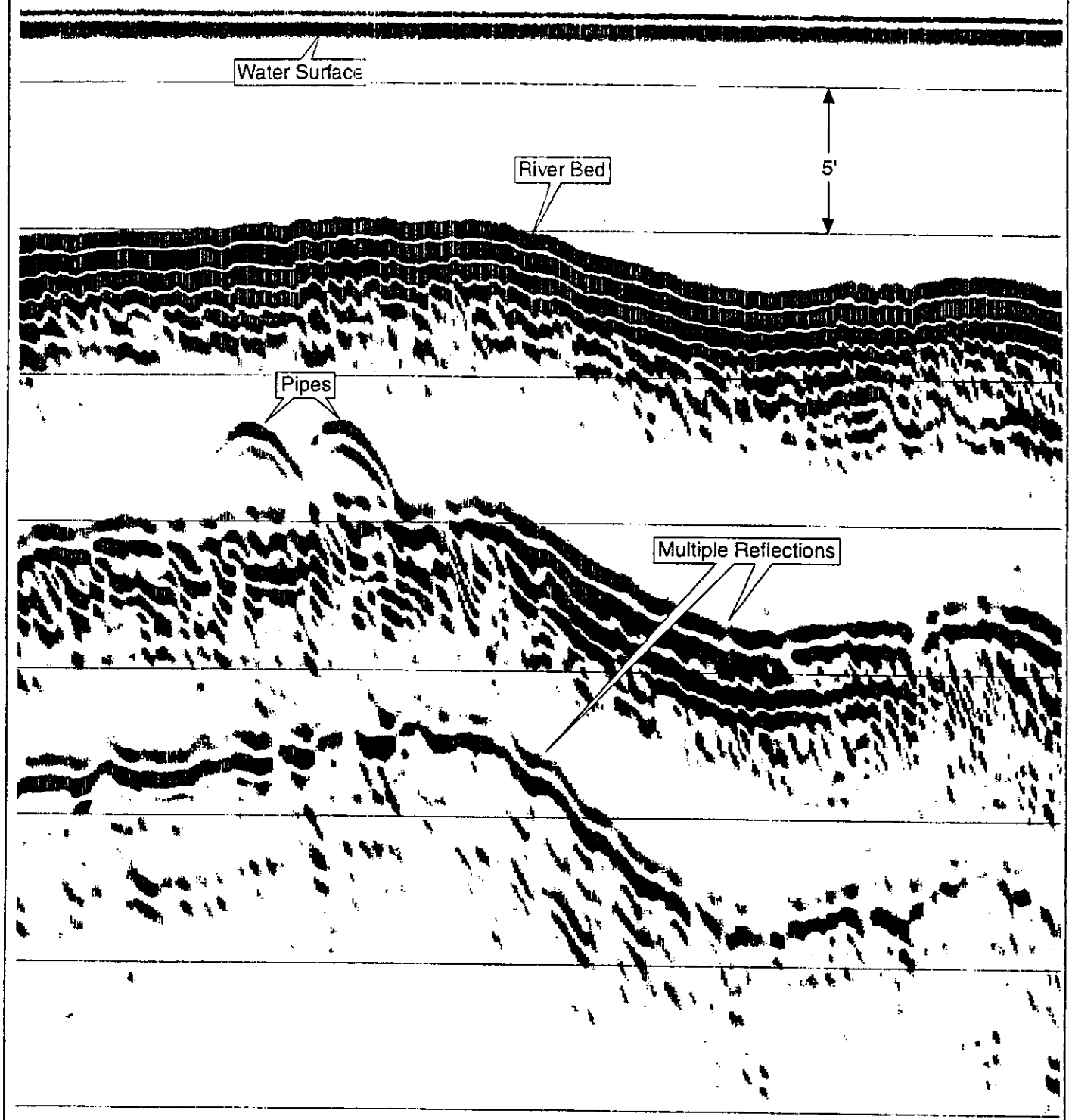


FIGURE 5
OFFSHORE PIPELINES AT SITE 100H
WHC/GEOPHYSICS/WA

PROJECT NO. 943 1104 DRAWING NO. 49718 DATE 6/1/94 DRAWN BY CB

Golder Associates

APPENDIX B

PLATES 1 THRU 9

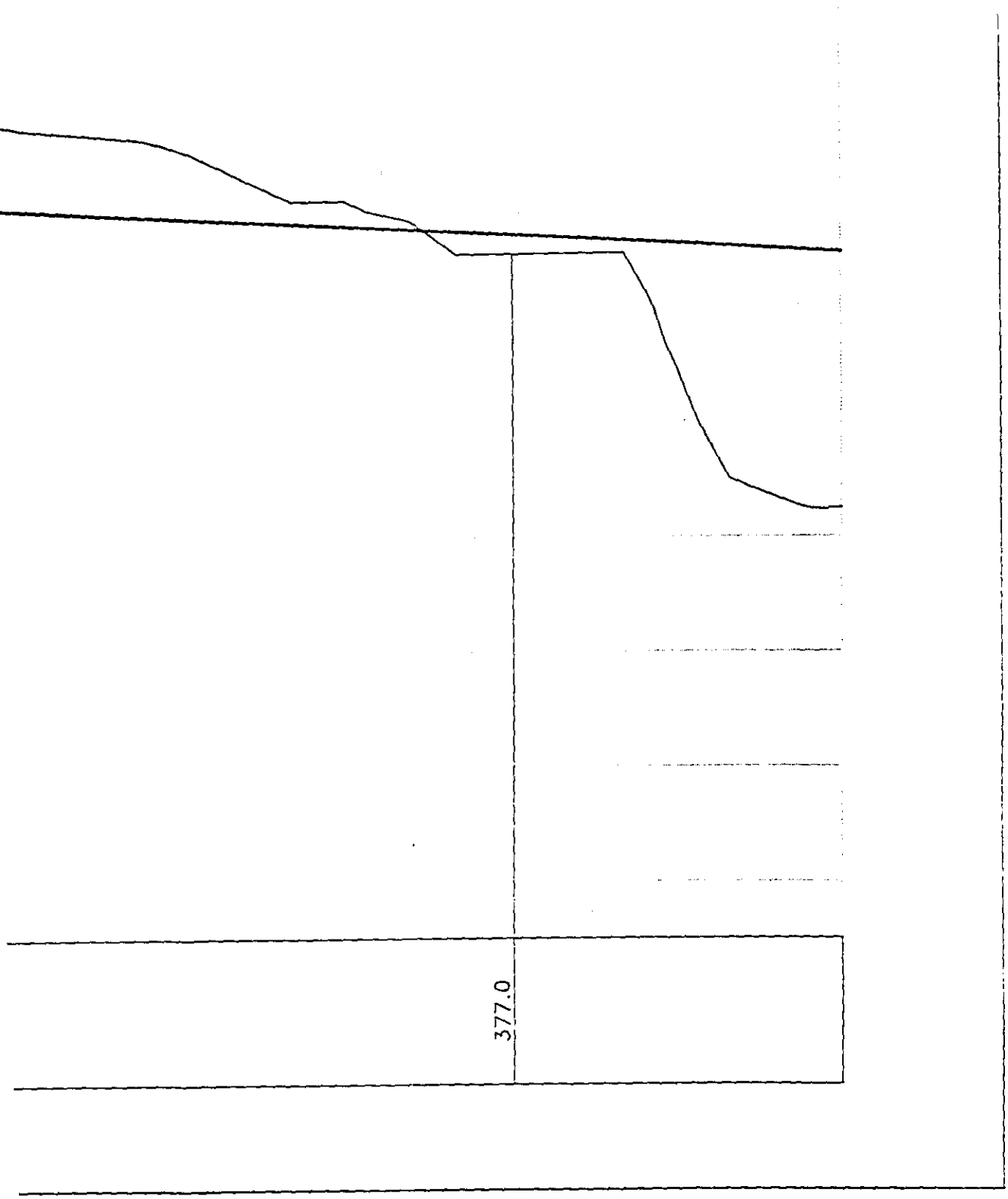


PLATE 1

PIPELINE AT B-7

WHC/COLUMBIA RIVER GEOPHYSICS

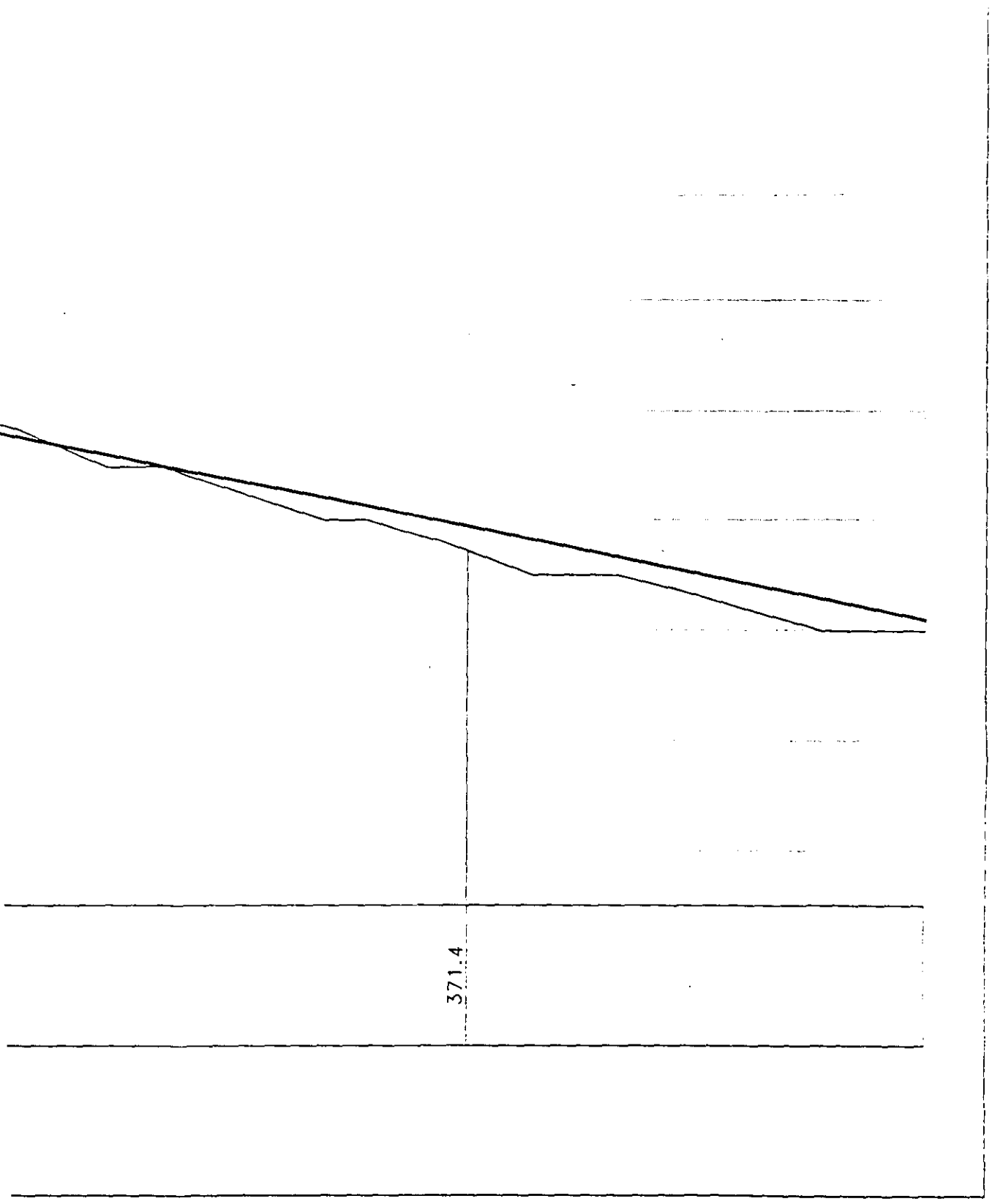


PLATE 2

PIPELINE AT B-8

WHC/COLUMBIA RIVER GEOPHYSICS

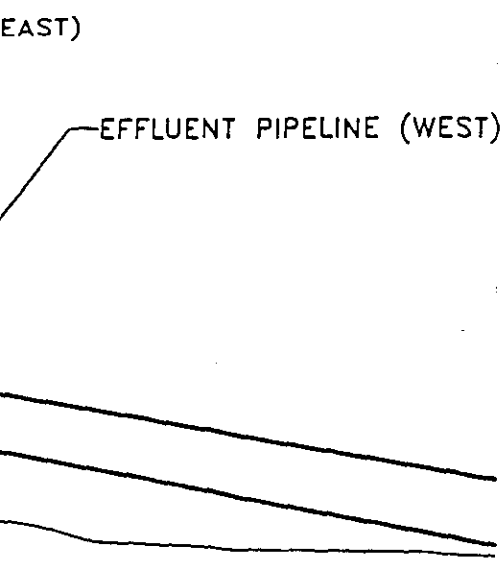


PLATE 3

PIPELINES AT C4

WHC/COLUMBIA RIVER GEOPHYSICS

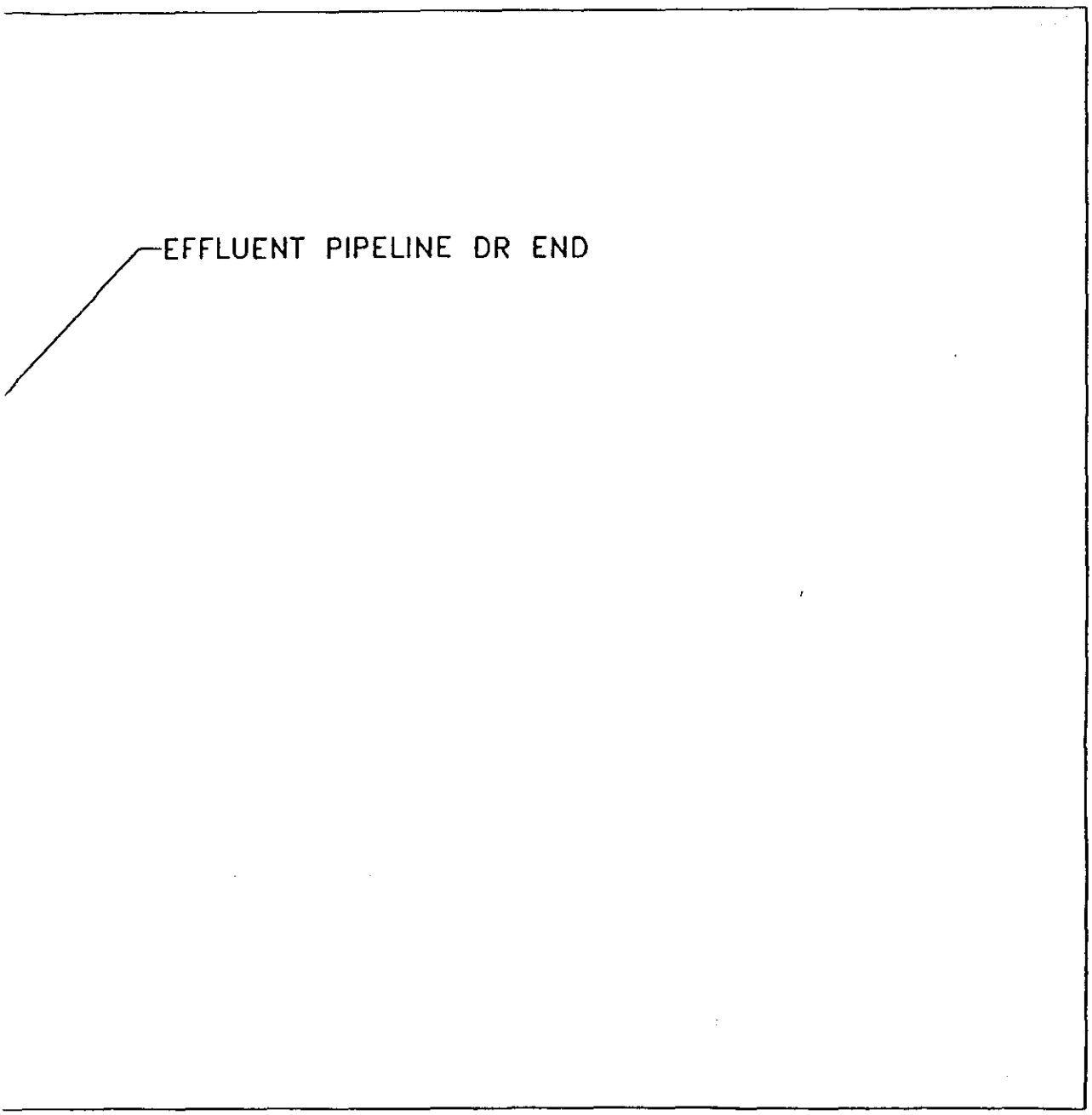


PLATE 4

PIPELINE AT DR

WHC/COLUMBIA RIVER GEOPHYSICS

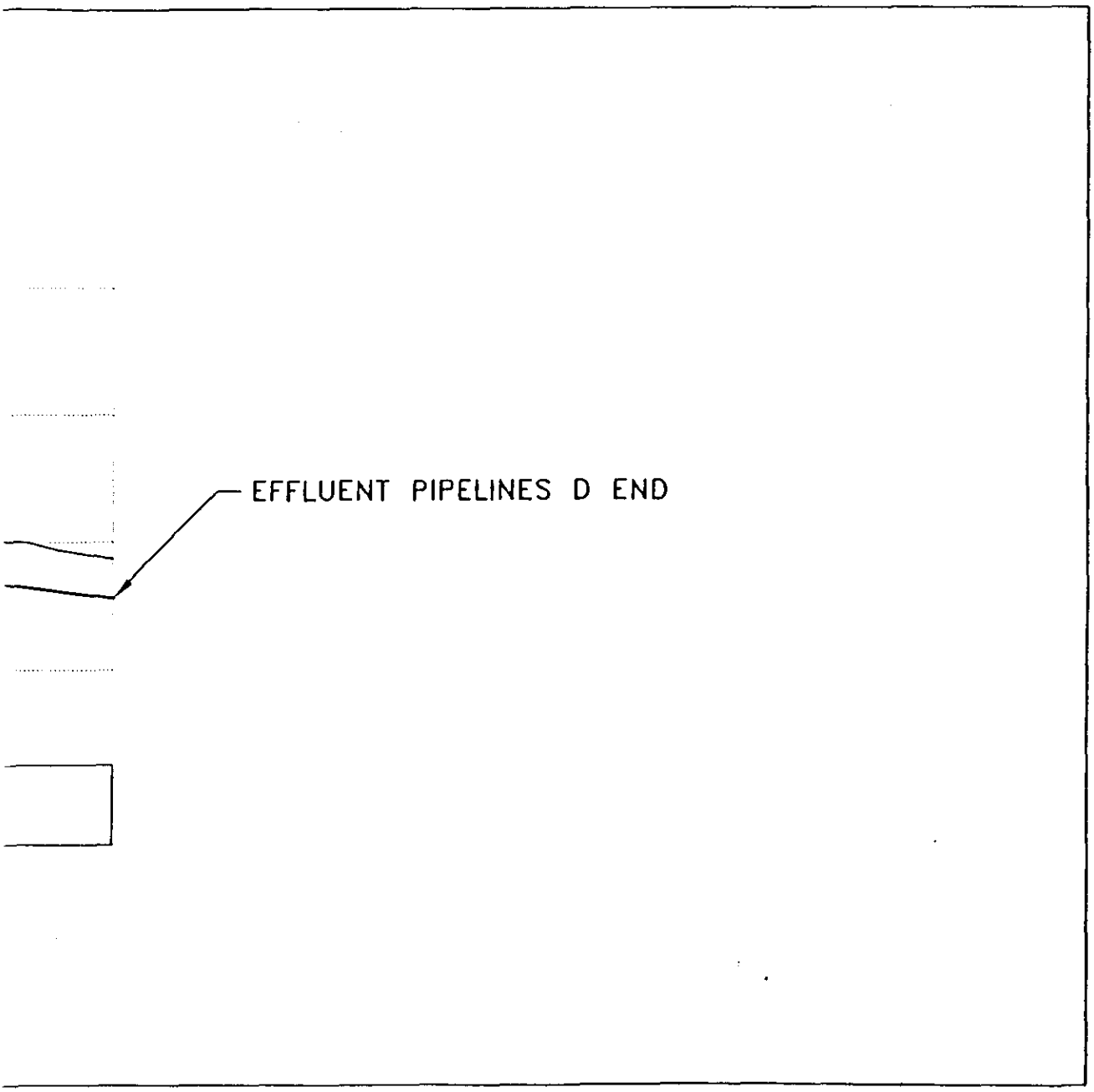


PLATE 5

PIPELINES AT D

WHC/COLUMBIA RIVER GEOPHYSICS

PLATE 6

PIPELINE AT F

WHC/COLUMBIA RIVER GEOPHYSICS

PLATE 7

PIPELINES AT H

WHC/COLUMBIA RIVER GEOPHYSICS

PLATE 8

PIPELINES AT K

WHC/COLUMBIA RIVER GEOPHYSICS

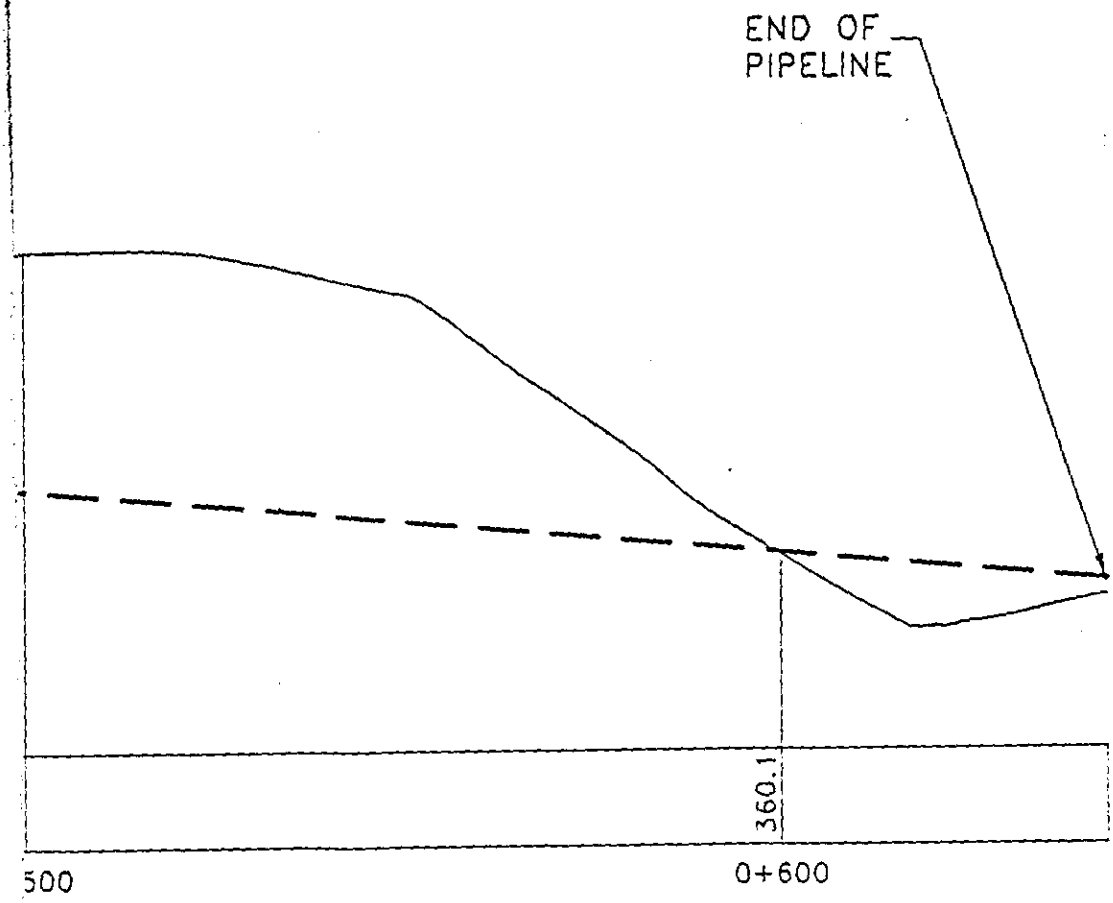


PLATE 9

PIPELINE AT N

WHC/COLUMBIA RIVER GEOPHYSICS